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FACET JOINT NITRIC OXIDE PRODUCTION IN PATIENTS WITH CHRONIC LOW BACK PAIN

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Introduction:

Chronic low back pain is a common problem resulting in suffering and costs to individuals and society. The exact mechanisms underlying chronic back pain are not well understood, however, disc degeneration and facet joint arthrosis have been suggested to be two major pain sources.

Nitric oxide (NO) is an oxygen free radical which is involved in a variety of biological events in different organ systems including inflammation, vasodilation and neurotransmission. NO has also been implicated in the pathophysiology of nerve injury following disc herniation. Increased concentrations of NO have been demonstrated with direct or indirect methods in temporomandibular[1] and knee joints[2] with osteoarthritis.

The aims of the present study were 1. To investigate if real-time NO concentrations can be measured in the perifacetal region and 2. To estimate perifacetal NO levels in patients with facet joint osteoarthrosis associated chronic low back pain and compare it with that of healthy controls, and 3. To investigate if perifacetal NO levels is discriminative for subsets of patients with facet joint osteoarthrosis.

Patients and methods:

The study was approved by the University of New South Wales Human Research Ethics Committee and informed consent obtained from all participants. Patients with at least six months duration of chronic low back pain with signs of facet joint osteoarthrosis on CT and/or MRI, were included in the study (n=26). Healthy volunteers were enrolled as controls (n=7). A detailed questionnaire including visual analogue scale (VAS) was completed by the patients before and six weeks after the NO measurements. Nitric oxide was measured with a custom designed electrochemical real time nitric oxide sensor (World Precision Instruments, Sarasota, Fl). The NO sensor has a detection limit of less than 0.3 nM, a linear response to NO concentrations up to 100 µM and can discriminate between NO and closely related substances such as nitrite[3].

The NO sensor was inserted into the facet joint through a 20 gauge needle under fluoroscopic guidance in patients and controls. All patients, received corticosteroids (0.4 ml Celestone®) and local anaesthetic (0.5-1.0 ml Marcain®) in and around the facet joint following the NO measurements. Descriptive parameters are expressed as mean ± standard error of the mean (SEM) and Mann Whitney's test was used for statistical comparison between groups.

Results:

It was possible to obtain NO measurements from all participants. No adverse effects were noted. The patients with chronic low back pain demonstrated 3-fold higher concentrations of nitric oxide in the perifacetal region compared to the healthy controls (1.66±1.39 vs. 0.46±0.37 nM, p=0.007, Fig 1).

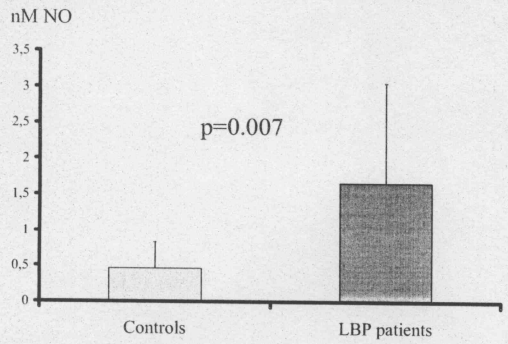

Figure1: *Concentration of nitric oxide in the perifacetal region in healthy controls and chronic low back pain patients.*

No association between nitric oxide concentration and pain-duration or pain-level (VAS) was detected. However, patients with a positive response to local anaesthetics and corticosteroid injection (detected as a reduction of VAS at a minimum of 20 mm) at the six week follow-up visit had 25% higher concentrations of nitric oxide when compared to patients who had a less than 20 mm decrease in VAS (Figure 2).

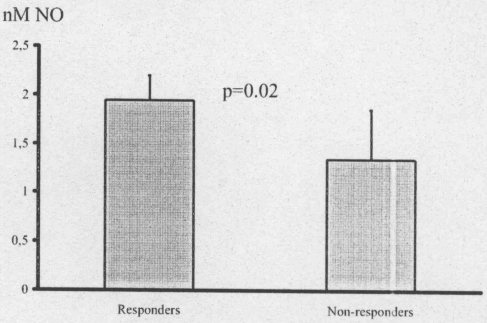

Figure 2: *The perifacetal concentration of NO in patients responding to corticosteroid/local anaesthetics (n=13) and non-responders (n=12).*

Discussion:

The study demonstrates for the first time that it is feasible and safe to measure NO with a real time-sensor around the facet joints.

The findings of higher concentrations of NO in the perifacetal region in chronic low back patients compared to healthy controls indicate that the degenerative process of the joints in these patients may cause increased NO production.

Patients that responded to corticosteroid/local anaesthetic infiltration had higher NO concentrations in the perifacetal region compared to patients without response. This observation indirectly suggests a more pronounced inflammatory process in the responding patients.

The possibility to detect ongoing local inflammation by measurement of real time nitric oxide production in or around spinal structures provides a promising new diagnostic tool in patients with chronic low back pain. Further studies are needed to evaluate the possibility to discriminate between different possible pain sources in patients with chronic low back pain.

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